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A UNIT-CONCEPT OF CONSCIOUSNESS.

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Psychology lacks a serviceable unit-concept of mind, that is, a cautious reduction of consciousness to the lowest terms compatible with the limitations of science. Vain efforts to sound the psychical depths that lie beyond the range of verifiable knowledge, we have had in abundance. The sleeping monads of Leibnitz, the soul-cells and cell-souls of Haeckel, the psyche that is not necessarily conscious, of Verworn, are some of the attempts to rationalize the regions of infra-consciousness, subconsciousness, or mere sentience. But these names mean the same thing if indeed they may be said to mean anything; they all suggest the same *tertium quid*, that bridge of cobweb, closed to science, spanning the chasm between conscious mind and insensate matter.

We are in need of a concept with more practical utility, one that will set bounds for comparative psychology by indicating how far downward in the scale of organic beings its surveys properly extend, also that will embody in itself the demonstrable antecedents from which the human mind has evolved. It is instructive to note how other sciences have profited by appropriate concepts of this sort and intention. Biology adopted the living cell, and wherever the cell is found the biologist has a legitimate field for his labor. Every physical science has analyzed its own subject-matter into simplest parts, each of which is conceived as similar in many important respects to every other. The purposes of the biologist did not require that the cell be divided into any lesser homogeneous units; but the physicist has made a further reduction of matter to molecules,

lying far beyond the range of the senses. The molecule is, consequently, rather a mental construct than a material object. The chemical atom at present illustrates the way a unit-concept may be altered to serve the purposes of advancing knowledge. Ions and particles are its outgrowths. For mechanics, there is the material particle, devoid of dimensions but possessing weight; and for geometry, the mathematical point, wholly immaterial but possessing position.

It is an accident that all these physical units have reference to matter and occupy space. Psychical units are equally possible, as is attested by the psychosis and the mental elements in descriptive psychology, the term in logic, the voluntary act in ethics, the family in sociology, and the like-minded group in the science of history. The sole qualification of every such unit is that it embody an auxiliary concept rendering a particular subject-matter more congruous and systematic. Psychology, treated as a natural science, needs some unit-concept that will systemize our notions of mind in organisms; the concept should involve a description of a certain type of mind, the simplest having the virtue of manifesting itself through bodily behavior so that its presence may become evident to the investigator. However, in psychology such a construction has never been attained, nor even scarcely attempted. It is a curious paradox, this case of a science seemingly in philosophic doubt concerning the reality of its own subject-matter. We defer to biology in treating lowly organisms as reflex machines, although this view places consciousness beyond the reach of investigation; and we borrow from physiology the unit-concept of the 'reflex-arc,' the peculiar feature of which is the absence of consciousness in all its operations.

If comparative psychology is not a possible science, by all means let us hasten to acknowledge the fact; if it is a possible science, much blame for its present condition belongs to psychologists themselves. Looking at the past, the whole body of psychological theory is seen to suffer by an overvaluation of the intellect at the expense of the other faculties; the result is a one-sided development of the science of mind. The study of sensation has been pursued so vigorously because, through the

senses, the mind is brought into relation with the physical world, and thereby the basis for intellectual development is laid. We have neglected almost completely the study of the feelings, which are the reactions of the mind itself upon receipt of these messages in the form of sensations. The formation of a serviceable unit-concept demands a better balanced treatment of the two sides of the problem, a fair consideration of the claims both of sensation and feeling. Unless this attitude is adopted, our conception of consciousness will be that of a mirror in which external reality is merely reflected, and a mirror-consciousness will never give external evidence of its own existence.

By calling attention to certain fictitious types of mind that have no dynamic relation to physical events, and thus have no significance whatsoever for science, we may acquire by contrast an idea of those absent features that might make such a mind an efficient factor and give it a 'survival value' in the process of organic evolution. In general, no mind composed either wholly of feelings or wholly of sensations could be made the object of scientific investigation.

For, in the first place, a creature without sensations could at best have only a series of panoramic visions, mere states of feeling in which to dream away its existence.[1] Secondly, a creature without feelings, though capable of sensation, could not be proved to exist. Indeed, no valid reason could be offered why it should be conscious of its sensations. If it had no subjective feelings, it would be indifferent to its sensations, in which case mere physical stimuli, acting on its body without arousing consciousness, would just as well serve to adjust it to its environment.[2] Again, by combining these two types in certain ways, we arrive at a third conceivable type of do-nothing consciousness, and also a fourth. For we may imagine the two groups

[1] This type is pure 'Gedankendichtung.' Dr. Holmes's 'Chambered Nautilus' is perhaps the best representative of the class. This organism had no inkling of the vital operations going forward in the webs of living gauze that formed its prison-house. But to the group belongs also a large assortment of sleeping monads, cell-souls, psyches, and psychoids.

[2] To this type belong all conceptions built on the analogy of the brainless frog, and the nerve-muscle preparation; it is schematically represented by the reflex-arc.

— the sensations and the feelings — as occupying, so to speak, two separate compartments. Then virtually two do-nothing minds might dwell in the same body and remain as indeterminate as either one would be if alone. Lastly, we may choose to imagine the two groups as connected in a pair-formation, like the order in which the animals came out of the ark — each particular sensation being on all occasions attended by its appropriate and invariable feeling, a strict monogamous relation. This last conception deserves careful consideration. It has been a more serious stumbling-block to psychology than one at first glance is apt to realize.[1]

To all of these types one judgment pertains: they are hypothetical, more hypothetical than is any disembodied spirit. If one should capture a disembodied spirit it ought wholly to suffice us; if, on the contrary, one should detect, somewhere in space, a do-nothing spirit of any of the above-described types, there would remain a second task, viz., that of establishing its transcendental connection with the particular organism that houses it. In what sense such a consciousness could *belong* to its own body would surely require an exceptional metaphysician to explain.

A historical survey of the doctrines reared upon these barren conceptions would not profit us in the present task. So numerous and influential have such views been however, that they have retarded psychology in its growth. Particularly undesirable are the doctrines advocated by many physiologists and biologists, which state that consciousness of every sort, even that of man himself, is of a do-nothing type. They have fostered the belief that mind has no causal relation toward matter and motion, consequently that no dynamic concept of mind can be formed. Condillac, by postulating sensation as the sole source of mental growth, rounded out a description that involved every factor of human consciousness. His doctrine of sensationalism went through its cruder stages to high degrees of refinement; but external stimuli were always taken as the only causes of sensation; sensations, the only causes of mind; the mind, there-

[1] This type supplies the mechanism for Descartes's theory of brute minds, for Condillac's marble statue, and for Clifford's automaton.

fore, could originate nothing, for it was an unalloyed product of its environment. Plainly this view did not transcend the limits of mirror-consciousness. And where is the flaw in the thesis that renders the conception impracticable for psychology, if psychology is at all possible? I think we find it in the fundamental assumption, that feelings are attributes of sensations: we are asked to suppose that when a particular sensation arises in consciousness, its proper feeling is bound to appear with it; the two are inseparable and the feeling is subordinate in that its specific nature is determined by the accompanying sensation as its immediate cause or occasion.

Out of this sensationalism developed the doctrine of automatism — merely by a refinement in terminology and a clearer vision of the implications involved. To the automatist, consciousness is an epiphenomenon, as ineffectual in the control of the bodily mechanism of any organism as the whistle of the locomotive is ineffectual over the running of the wheels. Yielding assent to this view with the scientist's besetting frailty for a paradox, we can give account of the origin of the manuscript of Hamlet, erasures and all, "without in the slightest degree acknowledging the existence of the thoughts in Shakespeare's mind."[1] With Judd I believe that all psychologists in years to come will regard this belief as "one of the curious fallacies of immature science."[2] Nevertheless, twenty years ago, no one could have formulated a theory of the feelings that would hold its own in debate against the clear and simple statements of the automatists. So feebly were their assertions disputed that Wundt, who has since led the psychologists out of this Egypt of materialism, was, in 1893, still treating the feelings of pleasantness and unpleasantness as attributes (Gefühlstöne) of sensations.[3] The exodus has since grown general, until, of all the notable leaders of the science, Professor Stumpf now stands

[1] James's illustration in *The Principles of Psychology*, Vol. I., v, 132.

[2] Judd, *Psychology, General Introduction*, 1907, p. 62. *Cf.* also Judd: 'Evolution and Consciousness,' PSYCH. REV., March, 1910, 77–97. An interesting sidelight on Judd's view of the function of consciousness is provided by F. A. Woods in an article, 'Laws of Diminishing Environmental Influences,' *Popular Science Monthly*, April, 1910, 313–337.

[3] Wundt, *Physiol. Psychol.*, 4te Aufl., 1893, Bd. I., Cap. x. *Cf.* also Titchener, *Psychology of Feeling and Attention*, 1908, Lecture IV., 125.

virtually alone as the champion of the position that pleasantness and unpleasantness are sensational.[1]

A new doctrine of the feelings has been forming, but it is far from completion, and uniformity of opinion is not yet attained. The change of attitude is seen in the treatment of sensuous feelings, no longer as attributes of sensations, but as owing their origin each to a great number of causes of which the sensation is merely one. A feeling is considered to be the resultant of all the factors present in consciousness at the time of its origin — of memory images, masses of organic sensations, lingering traces of previous feelings, *et cætera* — and when attention is particularly directed toward any incoming sensation, the prevailing feeling becomes 'sensuous' by becoming simpler and by having more direct reference to the sensation concerned. What, on this basis, a sensuous feeling would be like in an exceedingly simple sensorium, we are still unable to say, but at least its origin is to be attributed to some slight network of causes in the guise of contemporary sensations and lingering feeling, together forming a thin stream of consciousness.

In the light of this new doctrine, the cause-and-effect relation between the physical world and consciousness assumes a more complicated form. The living creature, in respect to its modes of behavior, can scarcely any longer be treated as a reflex machine, a mechanism completely controlled from without; it is apt to be an organism, autonomous, governed from within. The point at issue involves a nice distinction: we need not accord to the organism any freedom of will, nor need we enter into metaphysical problems at all. We are called to judge whether the laws of consciousness are inherently identical with those of external nature, in which case the phenomena of the two worlds form a single nexus; or whether these two bodies of law, however consistent, are different in that nothing else in nature conforms to the same government as does the mind. The latter alternative leads to the conclusion that consciousness is a unique and effective factor in the evolution of things; also that

[1] *Cf.* M. W. Calkins, 'The Abandonment of Sensationalism in Psychology,' *Amer. Jour. of Psychol.*, XX., 1909, 269. For a very able criticism of Stumpf's position, see Titchener, *op. cit.*, Lecture III., 81.

the mind should be accorded a 'survival value' in our scientific explanations.

If the mind accords to any unique law of its own, it is not probable that this law pertains directly to sensation; rather it is operative in the subjective group of mental phenomena, the feelings. We should make a division therefore on this basis. After assigning the body, and in particular the nervous system, to the proper place as a part of the physical environment of the mind, we should note that all sensations are results of external stimuli that directly produce certain physiological events in the brain; consequently, the sensations, *causally considered*, belong on the physical side in that they are direct results of what we are to call physical. On the other side lies the unchartered territory of the feelings. Present knowledge is very meager concerning them, but possibly enough is already known to point the way toward a serviceable unit-concept, since this quest involves feeling only in its most rudimentary forms.

Taking this view of the matter, we should try to keep the proposed concept as free from objectionable implications as may be, for this precaution will contribute to the general utility of the result. There seems no better way to accomplish this than by a strict observance of Occam's 'principle of parsimony'— not to make more assumptions than are necessary. It is like erecting a barrier around the unit-concept while it is in process of construction. The organism is not to possess any innate information concerning its environment, and the environment is not to wait outside, ready made, and eager for an opportunity to make itself better known to the mind pent up within the body; in other words, we shall abjure teleological aids. Also, inside the barrier, it is necessary to clear the ground of unverifiable notions, such as subconsciousness and certain 'powers of mind,' original intuitions of space and time, and the innate desire for pleasure and avoidance of pain. There should, of course, be no talk of complex mental states, ideas or percepts, no presuppositions about a conscious memory; nothing but sensations and feelings forming a somewhat consecutive flow on the surface of consciousness.

But no matter how cautiously we prepare for the attempt,

the proposal will meet with objections. Some will predict that we shall find ourselves restricted to a barren sort of structural psychology according to which the mind from the inside will appear formal and static, without the power to make itself move. Sufficient justification seems given by the fact that we are trying to form a working hypothesis, the merits of which must be determined by the character of the deductions that may be drawn from it in the field of functional psychology, that is, through the study of animal behavior. Another objection is more serious. It will be said that other minds are unknowable, that we cannot participate in any consciousness other than our own, and that the most primitive consciousness is the most inscrutable and unknowable of all. This is the usual objection offered by those whose main interest lies with the natural sciences. So cautious is Driesch on this score that in speaking of conscious organisms he adopts the term 'psychoid'— "that is, a something which though not a 'psyche' can only be described in terms analogous to those of psychology." And he also remarks that "the words 'soul,' 'mind' or 'psyche' present themselves, but one of them would lead us into what we have so carefully avoided all along, viz., pseudo-psychology."[1]

The view-point of Driesch is external to mind, and for biological theory perhaps it should be. The concept of a psychoid is a convenient though artificial means for limiting his universe of discourse. But why psychologists should adopt the same view is beyond rational explanation, for it means that a vast deal of time has already been wasted in developing a pseudo-science, and also that whatever they may contribute to it is but the outpouring of other psychoids and to be regarded and treated as such.

Even physical science does not allow the adoption of this agnostic attitude unreservedly. Many of its unit-concepts are

[1] Driesch, *The Science and Philosophy of the Organism* (*Gifford Lectures*, 1908), p. 82. *Cf. idem*, p. 53: "By no means, of course, do we intend by our appeal to psychology to introduce that sort of pseudo-psychology which we excluded from natural science when we were studying instincts. All acting organisms, including acting men, are to us simply *natural bodies in motion:* at least they are *immediately* presented to us as such. . . . These agents or factors, however, would by no means be psychological in the introspective sense — the only sense which the word 'psychological' may legitimately possess."

unknowable in exactly the same way as primitive consciousness is. Indeed the physical atom and the primitive mind are equally unknowable and in exactly the same sense,— unknowable as to what they are, but knowable as to what they do. Physicists use the concepts of power, energy, strain, without knowing anything about their intrinsic nature apart from what they are as states of human consciousness. Psychologists in fact do not leap as far when they attribute a ' feeling of strain ' or a ' sensation of contact ' to a primitive mind. But when a feeling of strain is postulated as an experience of a primitive mind, we do not mean that we can describe it. It is in that sense quite unknowable, and if it could be transferred into our own immediate experience we might not recognize it as similar to any of our customary experiences. As a postulate, it is formal, merely a typical conscious state standing in a definite relation to the initation of bodily movement, the same relation as is borne by feelings of strain in human consciousness.

Disclaiming all intention of describing concrete experiences as felt by lower organisms, let us proceed to a closer consideration of the three necessary assumptions already adopted, namely, consciousness, sensations, and feelings.

1. *Consciousness.* — A sensation, entering consciousness, as surely meets with an environment and reacts to it as does an organism when it enters upon its physical environment. On the basis of our theory, this reaction to a sensation takes the form of a feeling. Between the sensation and the feeling must be interposed some circumstance (if the mind be autonomous) which will permit us to expect that a given sensation will not invariably give rise to the same feeling. In other words, the mental environment becomes a conditioning factor in the rise of the sensuous feelings. This environment we call the state of consciousness existing at the time. Hobbes was certainly correct when he said that to have always the same state of consciousness and to have none at all were one and the same thing. We assume, therefore, a constant ebb and flow in consciousness, which may dwindle in content to a mere point or, again, may diffuse itself like dim twilight. This movement is expressed by the term attention.

Recently it has been suggested that "the amœba's conscious experience may be rather a series of 'flashes' than a steady stream" on the supposition that "there are no trains of ideas to fill up possible intervals between the occurrences of outside stimulation."[1] Perhaps this question need not be raised, because, to the organism concerned, the intervals between flashes probably are non-existent. Moderate continuity in the phenomenal flow would suffice. If, however, the amœba's experiences really appear to it as a series of flashes, then its consciousness can hardly be more than a kind of mirror.

A mirror-type develops also if we proceed on the assumption that, in the amœba, attention and inattention are meaningless terms. "Different moments of its consciousness," writes Miss Washburn, "may differ in intensity; but attention, involving, as it does, clearness rather than intensity, arises only when mental states have become complex and possess detail and variety in their structure."[2] Of course the amœba may not have reached the stage of conscious autonomy, but investigations appear to testify rather to the opposite opinion by showing that probably the requisite detail and variety are not lacking. To quote Jennings: "Even the naked protoplasm of *Amœba* responds to all classes of stimuli to which any animal responds."[3] A most natural guess is that in the absence of attention, dependent on degrees of clearness, the bodily movements would be stereotyped reflexes and the mind would belong to one of the mirror-types. That this is not the case even with the amœba, experimenters are becoming more and more convinced. Complex situations in such a mind are likely rare, but with a moderate degree of content, the stream of consciousness should begin to resemble our field of vision, with a clear and distinct area (Blickpunkt), a broader, less distinct area (Blickfeld), and beyond this a 'fringe' in which the content shades off into total obscurity. Organic sensations should provide a fairly continuous background. To conclude: A small amount of complexity, differentiated in clearness as distinguished from sensory intensity, is

[1] Washburn, *The Animal Mind*, 1909, p. 49.
[2] *Idem*, p. 49.
[3] Jennings, *Behavior of the Lower Organisms*, 1906, p. 261.

assumed as a necessary trait of any mind capable of manifesting its presence and thus existing as an object for science.

2. *Sensations.* — Irritability is a possession of all organisms, and actual contact is its primitive mode. No sense is telesthenic, not even sight or hearing. All stimuli act on organisms by contact. To none of the externally aroused sensations should we accord, in the beginning, any preëminence in virtue of its intensity or its quality; none provides any special endowment for overcoming the difficulties of the earliest stage of psychogenesis. In man, however, attendant circumstances differentiate certain internally aroused sensations from all other groups; these we call muscular sensations. No importance is attached to the fact that they are associated with contractions centrifugally produced, nor should conclusions be based on the doubtful presence of feelings of innervation when such contractions occur. But any organic movement is liable to cause sensations not only from the parts moved but also from the surfaces of the body, secondary results of the motion. This feature may early serve as a mark of distinction in consciousness between occasions when the organism is acting and when it is being acted upon. I shall employ the terms, tactual and muscular sensations, the latter to refer to sensations attending movement centrally initiated. All sensations may be regarded as formal and abstract, for whatever concreteness they actually possess is due to their affective accompaniments.

3. *Feelings.* — However much variety there may be among the sensations owing to their distinguishable qualities and intensities, the feelings are still far greater in number. Any feeling by its presence in consciousness is a guarantee that some sensation is present, but no specific feeling is guarantee for a particular sensation. Sensations may coexist, but no two feelings can coexist separately in the same consciousness, though one feeling may rapidly succeed another. Lists are extant purporting to comprise all the kinds of simple, irreducible feelings to be discovered in human consciousness, and from these may be selected such as seem indispensable for the lowest autonomous type of mind. According to the theory of Wundt there are three pairs of simple feelings: pleasantness and unpleasantness;

excitement and depression; strain and relaxation. These feelings are not to be regarded like notes in a musical scale, either as sounded always separately or as always forming musical chords. Each pair really stands for a continuous series of feelings indeterminate in number and ranging between opposites. The linear series, taken together, stand as coördinates in a continuum of three dimensions. Controversy has arisen as to whether this classification may be reduced to a system of fewer dimensions. Royce, retaining the pleasurable and unpleasurable feelings, holds that the other four can be represented by a single other dimension ranging between restlessness and quiescence. We do not adopt this proposed simplification because the result would give no sufficient basis for an effective unit-concept.

We shall assume but four fundamental feelings: those of strain and relaxation; of excitement and depression. Then, guided by facts of human experience, we define, as follows:

(1) The feelings of *strain* accompany a large *content* of sensation in consciousness; the feelings of relaxation are the reactions when the conditions causing the strain are removed.

(2) The feelings of *excitement* accompany a large amount of *change* in the sensory content, requiring or producing a rapid shifting of the attention; while the opposite feelings of depression are the reactions when the causes of the excitement are removed and consciousness becomes again more static.

It might be urged against the first definition that a feeling of strain often occurs although very little content be present, as when one is tensely awaiting the advent of a slight sound in stillness. Such strain, however, is largely sensory, due to muscular and organic alertness. Moreover, the experience implies a mind capable of selective attention to weak stimuli about to come. To a primitive organism there can scarcely be this interest in weak stimuli, and besides, it is a natural supposition that for such an organism the feelings in the beginning

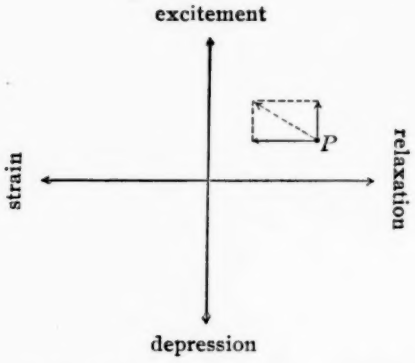
would be by no means prophetic or convey a reference to the future.

It may also be remarked that we omit the series of pleasurable and unpleasurable feelings. Psychologists often treat these feelings as preëstablished indices for the guidance of the mind in its choice of the foods which will prove beneficial to the body. There is something indeed miraculous in the function accorded to them, and the present writer disbelieves in it. Certainly the first feeling of pleasure must be entirely different from every previous experience, and we may despair of accounting for its being what it is; on the other hand, psychologists should not give up hope of discovering a reasonable explanation for its being attached to certain kinds of experiences while disagreeable feelings normally accompany certain other kinds. It is easy by complicating the discussion to avoid the main issue but the fact remains that, without appeal to the supernatural, the feeling of pleasure must be supposed at first to arise merely as an effect, and only later to assume the rôle of a cause influencing bodily behavior.

This, then, is our inventory of the indispensable factors in an autonomous mind: the four varieties of feelings mentioned above, and a mass of sensations, undifferentiated but soon to become so, the earliest line of cleavage among them being that which sets apart the muscular sensations which in man accompany what are called voluntary movements. In animals these sensations are attended by feelings of active strain, whatever those words may stand for. Let us next inquire how such a primitive mind would work, in order to gain some conception of its autonomy. To this end we shall follow the course of a typical process beginning with an external stimulus and ending in a bodily movement.

A stimulus, acting, does not insure the appearance of any sensation in consciousness. Rejecting the absurdity of unconscious sensations, we shall confine ourselves to those that attain the field of attention where they will gain various degrees of distinctness. Their dynamic value is probably measured by distinctness, which, however, is not always proportional to the intensity of the stimulation that causes them. Up to this point

the facts are conceivably explainable in physiological terms, so that the description might be taken as referring to a mechanical process.



If there is truth in this autonomous conception of mind it finds expression in the interaction of the incoming sensation with the inner state of feeling prevailing at that moment of time. In the above diagram we find a two-dimensional system representing all the primitive states of feeling arranged with respect to coördinates, so that the character of any prevailing affective state can be represented by the position of a point (P). This point, in order to conform to the actual condition in consciousness, must be conceived as continually moving, since 'to have one state of feeling continuously is the same as having no consciousness at all.'

Treating now any single incoming sensation as an isolated fact, we may signify the change to the next prevailing state of feeling (due to the advent of the sensation) by the shift produced in the position of the point. If the sensation contributes somewhat to the amount of *change* going on in the sensory content, it will either augment or produce a feeling of excitement, and this may be represented by a displacement of the point (P) upward; if it contributes to the *quantity* of the sensory content, this will make a displacement of the point in the direction of the feelings of strain, *i. e.*, toward the left of the diagram. The actual displacement might be represented by a resultant as determined by the familiar parallelogram of forces, *if we were dealing with a mechanical problem.* But this pro-

cedure would be in violation of the facts of consciousness as presented to immediate experience. Mental states obey a principle of relativity according to which any state comes to be what it is by virtue of all the past states with which it stands related. A state is profoundly conditioned especially by the states immediately preceding. To this may be added the law of contrast, applicable to special cases, according to which states closely related in time have their opposite qualities intensified by virtue of their proximity to one another. There are no laws such as these in physical nature, so the idea of a parallelogram of forces must be greatly modified before it suits the conditions of a mental environment.

Retaining the term 'parallelogram' as suggestive of its use, although no longer true of the shape of the figure, we may say, in reference to psychical conditions, that two parallelograms of different sizes but developed from the same position (P) will not be geometrically similar figures but will generally suffer unlike distortions. Likewise, two parallelograms of approximately equal size but developed from different positions of the point (P), will not likely be similar but will suffer unlike distortions. Added to this very complicated system of relations, there is probably, even when the sensory content remains relatively constant, a general drift or flow in the stream of affective states. Sufficient, no doubt, has been suggested to show that the point (P) moves in a territory which as yet has been very slightly explored. The attempt to use a diagram also shows how hopeless it is to try to express in quantitative or spatial terms the qualitative phenomena of the mind.

Another feature suggested by the use of our diagram is, that feelings of excitement and strain, when intensified, approach a limit at which a relapse takes place, and either consciousness fades out or else feelings of an opposite character usurp the field. We need make no assumption about any regulative principle such as a will, whereby a mind may control its own states. If the external agencies causing the stress in consciousness continue and perhaps increase in activity, the finale is the destruction of the organism. For this reason, a propitious environment is required for the maintenance of a species.

On the other hand, there is implicit in the autonomous mind the possibility of 'continuous adjustment of internal relations to external relations.' But to deal with this topic, we must step outside of the 'charmed circle' of consciousness, in order to consider the feelings in relation to corresponding bodily movements.

The body of a living organism is always moving, and every movement may be regarded as the result of contraction. The so-called expansive movements are no exception, so that the correspondence between feelings and bodily behavior is reducible to the simple relation of feelings to contractions. These contractions produce effects in consciousness somewhat similar to the effects of external stimuli in that contractions generate sensations by the contact and pressure of parts of the body against one another and against external objects. Therefore, an intense state of feeling always indicates the presence either of stimuli or contractile movements. The situation requires, then, only the undisputed fact that stimuli give rise to bodily movements, in order to make clear the regulated mode of behavior which is observed in all lower organisms. The real connection is often masked by the fact that active contraction may cause inhibition of movement instead of movement. So far nothing is disclosed but what can perhaps be explained in physiological terms. What then is the function of autonomous consciousness in respect to behavior?

The reply seems to be that consciousness by virtue of the shifting of its states of feeling in accordance with its own peculiar laws introduces greater variety into the series of possible responses to stimuli than would arise through mechanical causes acting alone. For every sudden violent stimulus there is probably some immediate stereotyped response which may remove the cause and suspend action; if, on the other hand, the causes continue in the form of sensations, then consciousness, not the environment, determines the character of the further responses. The range of the possible responses is of course limited by the anatomical structure of the organism concerned, and in the case of the lowest organisms the number of these responses is indeed often very small, so that external evidence

for a mind in such cases is necessarily meager. But there is sound judgment in the remarks of Jennings, that "we usually attribute consciousness to the dog, because this is useful. . . . If *Amœba* were so large as to come within our every day ken, I believe it beyond question that we should find similar attribution to it of certain states of consciousness a practical assistance in foreseeing and controlling its behavior."[1]

The practical manifestation of such a mind as I have tried to outline is clearly expressed in the words of Dr. C. S. Minot: "The function of consciousness is to dislocate in time the reactions from sensations."[2] When mind intervenes between stimulation and the muscular reaction, the sequence is broken up, or as here expressed, is dislocated in time. One of a variety of results may follow stimulation: either inhibition may occur and no response appear; or the forthcoming response may occur but in a modified form; or else a movement may occur when no stimulus is actually present, presumably in response to a stimulus that acted sometime before. The reason for this variety of consequences, as I venture to believe, is found in the different affective attitudes which consciousness presents toward its experiences at different times.

The mind from these statements appears in the rôle of a revolutionary agent bent upon breaking up the ancient reflex order of things. But to assume off-hand that all consciously-directed movements are the successors of simpler reflexes may be a case of putting the cart before the horse. At least the order of succession may be reversed; reflex acts may be regarded as the consequents of conscious acts. Driesch writes: "When I first tried, six years ago, to classify organic movements according to their degrees of complication, it seemed inevitable that the classification should start from two types, which in different respects are the most simple ones: the so-called *simple reflex*, and the simple free directive motion called '*taxis*.' Modern investigations have proved that these two groups of movement, though the most simple in concept, are far from being the most fundamental in fact, and therefore a classification

[1] *Op. cit.*, p. 337.

[2] C. S. Minot, 'The Problem of Consciousness in its Biological Aspects,' *Science*, N. S., Vol. XVI., p. 1.

of organic movements at the present day will have to follow other lines of analysis."[1] Jennings, after his thorough and patient study of animal behavior, says: "Each stimulus causes as a rule not merely a single definite action that may be called a reflex, but a series of 'trial' movements, of the most diverse character, and including at times practically all the movements of which the animal is capable."[2] As long ago as 1889 Wundt expressed the conviction that practice consists in making original acts, which were conscious and voluntary, more mechanical and finally automatic.[3] In the Grundzüge we read: "The reflexes are voluntary acts grown mechanical."[4] Titchener from these statements has developed the beautiful theory that mind is as ancient as life, that the first organic movement was a conscious movement.[5] If this were proved, it would mean a complete reversal of the old theory of behavior. All our unconscious actions — the beating of the heart, the passage of nourishment through the body, and all mechanical reflexes — would then be viewed as the direct descendants of a primal act consciously directed. Impossible of proof it is however, for we see but a part of the cosmic process and cannot generalize safely concerning the whole of it.

Nevertheless, whatever may be or may have been the condition at the lowest rungs of the ladder of organic evolution, the human mind attests the fact that at some stage below us consciousness became a factor in the process. A serviceable hypothesis relating to the mind at that stage of development is the goal toward which by our unit-concept we should endeavor to approach.

[1] *Op. cit.*, p. 8.

[2] *Op. cit.*, p. 280.

[3] Wundt, *System der Philosophie*, 1889, p. 548.

[4] Wundt, *Physiol. Psychol.*, 4te Aufl., 1893, Bd. II., p. 591.

[5] Titchener, 'Were the Earliest Organic Movements Conscious or Unconscious?' *Popular Science Monthly*, Vol. LX., No. 5, p. 458.

SOME EXPERIMENTS WITH REACTIONS TO VISUAL AND AUDITORY STIMULI.[1]

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'Simple' reaction times with auditory stimuli are commonly found to be significantly shorter than reaction times with visual stimuli, under otherwise identical conditions, although there are exceptions to the rule.[2] The explanation of this delay of the visual reaction as compared with the auditory reaction is as yet a matter for speculation, and we do not know whether it is to be referred to the interval between peripheral stimulation and cortical process, to apperception differences, or to motor inhibition. This paper is a preliminary report of methods and results of experiments bearing on this problem.

The specific points we have so far attacked are:

1. Reactions with simultaneous sound and light stimuli, when the attention is exclusively directed to one stimulus (sound or light), as compared with the reactions to sound or light stimuli alone.

2. The discrimination of light from sound, when there is reaction to one stimulus and not to the other, and the discrimination of the combination of the two from either separately, when there is reaction to the combination and not to the single stimulus.

4. The discrimination of light or sound alone from combination of the two, when there is reaction to the single stimulus and not to the combination.

The apparatus employed can be described here only briefly. The Hipp chronoscope was used in the first two groups of experiments. The chronoscope was checked by means of the

[1] From the psychological laboratory of the John Hopkins University.

[2] See Wundt, *Physiol. Psychol.*, 5th ed., III., 414, 416. Angell and Moore, PSYCHOL. REV., III., 245–258.

large Wundt fall-hammer in connection with a spark-chronograph, and ran with an average error of less than two sigma, which is small, when considered in light of the fact that an error of nearly one sigma in the reading was always possible. All our records may safely be said to be within two sigma of accuracy.

In the first day's work with the third group of experiments an accident disabled the chronoscope, and hence the records in this group were taken with the spark chronograph. We used the Schumann chronograph with the magnetic markers removed from the carriage, the 250-d.v. fork only being retained.

The visual stimulus was the illumination of a white screen by the flash of a helium tube. A Geissler tube could not be used, on account of the noise accompanying its flash. The helium tube flashes at lower pressure than a Geissler tube of the same length, and with no noise perceptible to the keenest ear, even when the ear is applied directly to the tube. The room in which the screen was placed was so darkened that the screen could barely be made out when the flash did not illuminate it. The reactor was given five or six minutes for adaptation. Under these conditions the flash illuminated the screen with a bright light which was not perceptibly tinged with color.[1] The screen, 16 × 20 inches square, was suspended vertically before the reactor, with center about on a level with his eyes, and approximately a yard therefrom. The tube was on a level with the top of the screen, and fifteen inches in front of it, shielded from the eyes of the reactor. The illumination of the screen appeared uniform. Early in the experiments an attempt was made to use the flash diffused through ground glass, but this was not found satisfactory.

The auditory stimulus was a snap in a telephone receiver which in the first two groups of experiments was held over the reactor's ear by an ordinary operator's headpiece, and in the third group was supported on a rod close to the reactor's ear.

A large Ruhmkorff coil was used to produce the spark for the operation of the helium tube. A specially constructed key, by one pressure of the operator's finger first closed the primary

[1] The illumination was really yellowish.

circuit through the spark coil, and a moment afterwards broke that circuit and simultaneously completed the circuit through the chronoscope magnets. The current was supplied by storage cells, and kept constant by the aid of volt and ammeter readings.

An automatic cut-out, designed and constructed for the purpose, 'shorted' the secondary circuit of the coil at the closure of the primary circuit, so that the 'make' spark did not affect either the helium tube or the telephone circuit described below. Thus the 'break' spark which occurred at the moment of the closure of the chronoscope circuit was alone used. Physical measurements showed that the delay of the spark after the actual break of the primary circuit was less than one fourth sigma.

A spark gap of adjustable width was inserted in the spark circuit, and shunted around the gap was the nominal secondary circuit of another and smaller inductorium. The nominal primary coil of this inductorium was connected with the telephone receiver, and hence by the passage of the spark from the large inductorium a current was generated in the telephone circuit, causing a sharp snap of the diaphragm. By varying the width of the spark gap, and so varying the amount of spark current sent through the smaller inductorium, the loudness of the auditory stimulus could be finely controlled. In practice the sound was made decidedly loud: but not disagreeably so.

The telephone receiver could be completely disconnected from the coil by the opening of a double-pole switch. By means of another switch the whole spark current could be turned off the helium tube and turned on a Geissler tube in the operator's room. Thus, at the option of the operator, auditory stimulus alone, visual stimulus alone, or both together could be given to the reactor.

The automatic key described in *Psychological Monographs*, Vol. 10, No. I., 26–37, was used throughout. A catch, holding the key down when completely depressed, was added. This catch did not interfere with the automatic action of the key, and by keeping the circuit broken until released by the reactor, gave the operator time to release his key, without the necessity of instructing the reactor to hold the key down for a moment after

reacting. The automatic key enabled the subject to make his attention essentially 'sensory,' as will be described below.

When the spark chronograph was substituted for the chronoscope, the primary circuit through large inductorium and reactor's key was broken mechanically by the revolution of the drum, and immediately (in ten or twelve sigma, that is) remade. The same spark which traversed the helium tube (or Geissler tube, in case there was no visual stimulus) was carried from tuning-fork stylus to drum. The reactor, by again breaking the primary circuit, produced a second spark, and of course a second stimulus. This was a condition not present in the first arrangement, with the chronoscope.

In work following that reported here a different arrangement will be employed. The auditory stimulus will be the noise of the spark leaping a gap, and there will be a separate inductorium in the reaction circuit, so that the reaction will not be accompanied by a repetition of the stimulus.

The subject was given a tactual warning or preparatory signal. A specially constructed instrument held in the left hand vibrated when an interrupted current was sent through it. The vibration was commenced approximately two seconds before the reaction-stimulus, and continued approximately half a second. The subject could communicate with the operator by tapping on a Morse key placed beside the reaction key.

The room in which the subject was placed was separated from the operator's room by a hall way. Both doors being closed, the operation of the stimulating and recording apparatus could not be heard by the subject.

The reactor's attention was 'sensory' throughout. After the first day or two there was no consciousness of the hand or expectation of the movement after the warning signal, and very little consciousness of the reaction or the hand between reactions, except in the case of the discriminative reactions. The attention, after the warning, was exclusively to the prescribed stimulus, and the effort was simply to perceive it at the earliest possible moment. Such at least was the definite introspection of three of the four reactors. The reactors were warned not to hurry the hand or otherwise to interfere with it, and instructed

to let it and the reaction alone, and to attend strictly to the stimulus after the warning signal. Complete 'sensory' attention at an early stage of an experiment is possible only with an automatic key. With an ordinary key the reactor must give a certain amount of attention to the hand until he has had long practice.

There were four reactors in these experiments: two graduate students, G. R. Wells and H. M. Johnson; an undergraduate, J. Marston; and the author.

Averages mean very little in reaction time results. Mean variations mean still less. The method of Tigerstedt, which groups the reactions according to the limits within which they fall is especially good, but convenient comparison and summarization of different experiments is difficult if dependent on the primary groupings. Plotting the graphs based on the groupings (Alechsieff's method) helps the eye, but does not compensate for the space and labor it requires. Graphs also lend a fictitious importance to the results, as there is no essential relation between the ordinate and abscissa, hence the experimenter usually selects a scale of the two which gives an imposing height to the graph as compared with its width. A similar remark about the use of percentages instead of actual number of experiments in the groupings of Tigerstedt's method, is quite legitimate.

We give in the statements below, the averages for the daily groups of experiments, with distribution tables for the total number of reactions of each class for each subject. In addition, we give the limits within which certain percentages of the total number of reactions fall. The percentages selected, as a result of careful study of these and other results, are 80 and 50. While this selection is arbitrary, we believe it will be found that the percentages indicated, when determined by the rules set forth below, are the most significant in the greater number of cases. The rules for determining the limits are as follows:

1. Take the fewest consecutive groups which together include 50 per cent. or more of the total number of reactions.

2. Take the fewest consecutive groups which together include 80 per cent. or more of the total number of reactions.

3. If in any case there are two sets, of equal number of groups, which include 50 per cent. or more (or 80 per cent. or more) of the total number, take the group containing the higher percentage. If the two groups contain equal percentages, take the group containing these two.

The application of the last portion of the third rule is illustrated in the case of the *F-dsf* results of Reactor W. 210–270 and 230–290 each include 51.1 per cent. Hence the group taken must be 210–290, including 61 per cent.

1. Reactions with Single and Combined Stimuli.

Four classes of reactions were produced in these experiments, according to the following conditions of attention and stimulation. (*S*); sound stimulation only. (*F*); visual stimulation only. (*Sf*); combined stimuli, but reaction to the sound — the attention in the preparatory interval being directed exclusively to the sound. (*Fs*); combined stimuli, but reaction and attention to the flash.

Ten reactions of each class were taken in succession, two to four reactions being allowed before beginning the series for the reactor's adjustment, and not recorded. One series from each class, forty reactions in all, constituted a period's work, requiring from thirty to forty minutes. Usually only one period's work was done in a day by one subject; in a few cases two periods of work were done, but not in immediate succession.

The four classes of series were taken up in eight standard orders, to equalize the effects of position in the set. These orders were: I., *F-Fs-S-Sf;* II., *S-Sf-F-Fs;* III., *Sf-S-Fs-F;* IV., *Fs-F-Sf-S;* V., *Sf-F-Fs-S;* VI., *Fs-S-Sf-F;* VII., *S-Fs-F-Sf;* VIII., *F-Sf-S-Fs.*

Through a mistake series in three other orders were included. These sequences were: A, *Sf-S-F-Fs;* B, *Sf-F-S-Fs*, and C, *F-S-Sf-Fs.*

The reactors reported that in the cases of *Sf* and *Fs* attention was almost without exception to the indicated stimulus, and the other was in consciousness only after its presentation. All reported that the reactions to *F* seemed much slower than the reactions to *S*. The reaction to *S* seemed to follow directly

upon the stimulus, as viewed in retrospect, while there seemed to be a slight pause or hesitation in the case of the reaction to *F*. Several persons, not concerned in the experiments here reported, have made similar observations in this laboratory. This introspection is of no little importance.

The averages of the daily series in this experiment are given in Table I.

TABLE I.

AVERAGES BY SERIES, IN σ.

Reactor.	Ser.	Seq.	(*S*)	(*F*)	(*Sf*)	(*Fs*)
J.	1	II.	174.9	176.1	146.2	152.8
	2	II.	106.7	170.3	101.0	116.2
	3	II.	105.0	146.5	81.09	113.0
	4	III.	93.7	133.2	89.2	103.9
	5	A	94.6	148.9	101.9	102.6
	6	B	73.4	139.0	89.3	93.9
	7	III.	84.4	161.7	77.5	72.0
	8	VII.	82.2	179.3	101.5	113.9
	9	I.	88.2	138.9	104.9	96.7
	10	V.	119.2	150.8	123.3	136.8
	11	VIII.	104.0	165.3	109.9	125.1
	12	VI.	99.7	159.6	108.6	109.9
	13	IV.	166.4	155.0	157.0	143.3
M.	1	I.	116.9	165.8	117.2	147.5
	2	C	92.0	150.2	95.7	132.7
	3	VIII.	104.8	159.3	97.0	126.7
	4	I.	82.5	153.3	84.1	116.7
	5	VI.	117.4	154.9	88.3	134.5
	6	III.	100.7	151.6	109.3	127.7
	7	II.	97.4	162.8	87.0	107.2
	8	IV.	74.7	157.2	62.7	105.5
	9	V.	100.1	166.4	83.2	94.5
	10	VII.	81.5	164.8	118.3	110.6
W.	1	IV.	127.2	176.7	149.3	197.0
	2	III.	159.2	178.7	122.7	144.2
	3	II.	120.4	178.9	111.8	149.6
	4	V.	131.4	164.0	123.9	141.9
	5	I.	135.5	178.0	123.1	138.3
	6	V.	82.1	166.2	105.1	124.8
	7	IV.	118.9	162.3	110.9	138.5
	8	VI.	98.4	186.2	130.0	135.3
	9	VII.	103.0	186.6	132.9	128.4
D.	1	II.	96.2	156.5	99.7	109.2
	2	III.	124.0	195.9	127.9	116.8
	3	VI.	116.5	199.1	140.0	149.7
	4	D	79.8	187.7	92.8	114.1
	5	I.	108.6	161.0	117.9	107.9
	6	IV.	104.6	140.5	106.4	107.5
	7	V.	92.6	134.7	110.1	93.0
	8	V.	116.9	150.7	116.7	155.3
	9	VII.	135.5	166.1	115.1	130.8
	10	VIII.	96.1	174.1	95.3	110.8

TABLE II.

DISTRIBUTION BY GROUPS OF 10σ DIFFERENCES.

Times.	*Reactor J.*				*Reactor M.*			
	S.	*F.*	*Sf.*	*Fs.*	*S.*	*F.*	*Sf.*	*Fs.*
From	1	0	0	1	0	0	3	0
40	2	0	3	3	3	0	4	0
50	2	1	3	1	4	0	0	4
60	5	0	4	4	5	0	6	2
70	14	1	11	7	12	1	11	2
80	19	0	12	10	10	0	13	4
90	19	1	18	15	21	0	15	13
100	19	1	27	18	17	1	16	12
110	14	1	20	16	9	1	9	21
120	9	5	4	18	9	2	8	8
130	2	13	10	14	7	3	6	17
140	8	21	6	7	2	18	2	12
150	4	32	3	3	0	28	2	4
160	3	24	3	5	1	22	0	3
170	4	15	1	4	0	15	0	1
180	1	7	0	1	0	6	0	1
190	0	1	2	0	0	2	0	0
200	1	0	1	1	0	1	1	0
210 up	2	2	0	0	0	0	0	0
Totals	129	125	128	128	100	100	100	100
	Reactor W.				*Reactor D.*			
From	1	0	2	0	1	0	1	0
50	1	0	2	1	0	1	1	1
60	5	0	2	1	1	0	1	2
70	5	0	2	1	7	2	6	5
80	6	2	5	3	13	0	2	6
90	9	1	4	3	13	0	10	11
100	15	0	7	10	24	0	32	18
110	4	0	10	6	17	0	17	19
120	13	1	12	11	12	1	16	10
130	12	11	16	14	5	6	5	9
140	4	2	10	14	2	16	3	7
150	2	12	9	5	2	23	2	4
160	6	11	3	4	1	11	2	3
170	0	17	2	4	0	7	0	2
180	3	10	1	5	0	12	2	0
190	1	5	2	3	1	6	0	3
200	2	5	1	2	0	6	0	0
210	0	3	0	2	0	4	0	0
220	0	3	0	0	0	1	0	0
230 up	1	7	0	2	1	5	0	0
Totals	90	90	90	90	100	101	100	100

Table II. gives the distribution of the individual reaction times in groups differing serially by ten sigma. The numbers in the first vertical column indicate limiting lengths of reaction times. A number in one of the following columns indicates the

number of reactions, of the class indicated by the column heading, which fall within the limits of the time opposite which the number is placed and the next higher designated time, reactions falling on the even time being counted in the group of which that time is the lower limit. Thus, the number 14 in the fifth horizontal line below the headings, in the second vertical column, indicates that of 129 reactions to sound alone by reactor J., 14 reactions were 70 sigma or more in length, but less than 80 sigma.

The limits within which fall percentages of reactions nearest above 50 per cent. and 80 per cent. of the totals given in Table II. are given in Table III.

TABLE III.

DISTRIBUTION OF CRITICAL PERCENTAGES.

Reactor.	*S.*	*F.*	*Sf.*	*Fs.*
J. Total	129	125	128	128
Per cent.; σ	86 ; 60–160	84 ; 130–180	80 ; 70–140	82 ; 70–150
	55 ; 80–120	61 ; 140–170	50 ; 90–120	50 ; 90–130
M. Total	100	100	100	100
Per cent.; σ	85 ; 60–140	83 ; 140–150	84 ; 60–140	83 ; 90–150
	57 ; 80–120	50 ; 150–170	53 ; 80–120	58 ; 100–140
W. Total	90	90	90	90
Per cent.; σ	84 ; 70–170	80 ; 130–210	80 ; 80–160	80 ; 100–190
	58 ; 90–140	54 ; 150–180	53 ; 110–150	50 ; 110–150
D. Total	100	101	100	100
Per cent.; σ	91 ; 70–140	86 ; 130–210	80 ; 90–140	85 ; 70–150
	54 ; 90–120	55 ; 140–170	65 ; 100–130	58 ; 90–130

The differences between the auditory and visual times are considerable. The fact that reactions to *Fs* are very little longer than reactions to *S*, although the attention and predetermination of the reaction in the former case were to the flash alone, may possibly be taken to mean that the reaction was really to the sound. This explanation is not indicated by the experiments described in the next section. The experiments with the *Sf* stimulus were valuable chiefly because they enabled the reactor to control his attention in the experiments with *Fs*.

2. REACTIONS WITH DISCRIMINATION.

For the purpose of throwing light on the relation of the *Fs* reaction to the *F* reaction and the *S* reaction, experiments were

made on three subjects by giving in irregular sequence *Fs* and *S* stimuli, and requiring the subject to expect the *Fs* stimulus, premeditating reaction to that and not to the *S* stimulus. Each series was composed of twenty of each type of stimuli, given in the order determined by the shuffling of a pack of cards. Reactor D. was given this type of discrimination test alone. Reactor J. was given in the same period a series of this kind with another series in which *F* and *S* stimuli occurred, reactions being to the flash. These two types of series, which we will designate as *Fs-ds* and *F-ds* respectively, were given in reversed order on alternate days, that is, on one day the *F-ds* series was given first, and on the next day the *Fs-ds* series first. Series of *S* and *F* stimuli, in which reactions were to sound and not to flash, were given to reactor *W*, but not on the same days with the *Fs-ds* and *F-ds* series. This third type of series will be designated *S-df*.

Contrary to our preconceived notions, the attention in these experiments remained 'sensory.' The understanding and resolution before beginning a series that the reaction was to be to one stimulus and not to the other, with at first a reversion to this consideration in the intervals between experiments, was all the needed consciousness of the motor process itself. This introspection became unquestionable in the discrimination experiments which are described in the next section.

The averages of the reactions in the *S-df*, *Fs-ds* and *F-ds* series are given in Table IV., and the distribution of the critical percentages in Table V.

Two things are shown by these meager results. First: that the shortening of the visual reaction time when an auditory stimulus accompanies the visual stimulus is not explicable as due to reaction to the sound instead of the flash, for the reaction to *Fs* is generally shorter than the reaction to *F* when both are discriminated from *S*. Second (in the case of reactor W.): the time of reaction to *S* discriminated from *F* is shorter than the time for reaction to *F* discriminated from *S*. The reaction time for *S* discriminated from *F* is actually shorter than the 'simple' reaction time for *F*. This same relation was found to exist in results of short series obtained from the other reactors,

TABLE IV.

AVERAGES BY SERIES.

Reactor.	Ser.	*Fs-ds.*	Errors.	*F-ds.*	Errors.	*S-df.*	Errors.
W.	1	213.3	0	209.2	0	157.4	0
	2	185.5	0	202.1	0	125.5	0
	3	179.5	0	198.8	2	128.0	1
	4	——		——		177.0	0
J.	1	209.1	1	186.0	0		
	2	156.3	1	173.8	0		
	3	153.9	4	175.2	4		
	4	140.8	1	157.6	1		
	5	139.8	2	167.7	0		
	6	130.1	2	158.6	0		
M.	1	——		167.0	3		
	2	——		181.5	0		
	3	——		167.3	0		
	4	——		147.5	2		
	5	——		160.6	1		
	6	——		157.8	2		
D.	1	169.0	0				
	2	132.7	8				
	3	137.1	2				
	4	139.2	2				

TABLE V.

DISTRIBUTION OF CRITICAL PERCENTAGES.

Reactor.	*Fs-dS.*	*F-dS.*	*S-dF.*
W. Total	60	60	80
Per cent.; σ	80; 140–220	80; 170–250	83; 90–180
	51; 160–210	60; 170–220	50; 120–160
J. Total	120	120	
Per cent.; σ	86; 110–200	81; 130–190	
	56; 120–160	59; 150–180	
M. Total		120	
Per cent.; σ		81; 130–180	
		50; 150–170	
D. Total	76		
Per cent.; σ	80; 100–170		
	55; 110–150		

but the data in these cases were not sufficiently numerous to warrant insertion in the table.

It is obvious that there is here a field for work from which the results will be exceedingly significant. Before undertaking comprehensive investigations of the points upon which we have

just touched we turned to a more difficult form of discrimination, and obtained some results which are detailed in the next section.

3. Reactions with Inhibitory Stimuli.

The discrimination of light from sound, or *vice versa*, is not especially difficult. There is some reason for supposing that after a reasonable amount of practice the reaction to *F-ds* and *S-df*, without errors, might be practically the same as the 'simple' visual and auditory reactions respectively. The discrimination of *Fs* from *S* is decidedly more difficult: the discrimination of *Sf* from *F* we have not yet tried.

When we come to the discrimination of *S* from *Sf* and the discrimination of *F* from *Fs*, the difficulty increases enormously. In these cases the reaction-stimulus is given each time, but in half the cases is accompanied by the stimulus of the other mode, which is expected to inhibit the reaction.

Series were taken on all four subjects with the stimulations *F-dsf* and *S-dfs*. Each series consisted of twenty reaction-stimuli (*S* or *F* as the case might be), and twenty inhibition stimuli (sound and flash combined). These stimuli were given irregularly as determined by the shuffled cards. The spark chronograph was used in these experiments, making the operation more difficult than in the preceding series; and occasionally records were spoiled, so that the full number of twenty was not obtained in every series. Sometimes the operator became confused, and used the same card twice, so that in some series there were more than twenty reactions. Errors, that is, reactions to the combined stimuli, were noted by observing the spark, so that an injury to the records did not prevent a complete report of the errors in any series.

One series of each type, the order reversed on alternate days, constituted a day's work. The subject's attention was in all cases sensory. No effort was made to react in one case or inhibit the reaction in the other: the whole effort was put into the discrimination of the single stimulus from the combination of the two, and in the cases of three reactors (J., W., and D.) the way in which this was done was introspectively clear. The reactor expected the single stimulus (sound or flash), represent-

ing that stimulus as distinct from the combination, and attending positively to that representation. No attention was given positively to the combined stimuli although it may be inferred that in a negative way the inhibitory stimulus complicated the expectation. When this state of attention was maintained up to the moment of the stimulus, the reaction occurred if the stimulus was the expected one. If the stimulus was not the expected one, the reaction never occurred. But the requisite attention was not always maintained, being occasionally disturbed by noises from the rooms adjoining the subject's room, and if the attention to the reaction-stimulus was lost just before the stimulus, the reaction occurred without regard to which stimulus was given.

It would be desirable to obtain series in which there were no errors, but we succeeded in obtaining only a few of these. The reactors labored under especial disadvantage because of having been habituated to reaction to the combined stimuli in the earlier experiments. More work will be done with fresh reactors, and with the present ones after several months' rest.

The occurrence of errors does not necessarily discredit the series in which they occur. The pairs of series in which the errors are equal, and the pairs from which errors are absent, show in general the same relationships as the pairs in which there are in one series more errors than in the other. The effect which the disposition to error may have on the reactions to the right stimuli is in itself a problem which is not simple.

It is noteworthy that more errors occurred in the *S-dsf* series than in the *F-dfs* series. Reactors W. and D. found introspectively that the maintaining of attention was more difficult in the former series than in the latter. Reactor J. on the other hand reported that attention to *S-dsf* was the easier, although he thought that his attention to *F-dfs* was the better. This latter condition he said was due to the fact that he made more effort in the *F-dfs* series, which probably accounts for the divergence of his results from those of the other three reactors.

In the consciousness of all three subjects the sound became associated with darkness, and the light with silence, as positive content, thus becoming a complex expectation-content.

The introspection of Reactor M. did not differ in substance

from that of the others, but no stress is laid upon his reports here, because he was absolutely untrained in psychology.

The averages of the series are given in Table VI., and the distribution of the critical percentages in Table VII.

TABLE VI.

AVERAGES BY SERIES.

Reactor.	Ser.	*F-dfs.*	Errors.	*S-dsf.*	Errors.
W.	1	247.1	0	293.7	0
	2	302.6	0	255.4	1
	3	282.0	1	240.7	1
	4	273.2	1	237.8	3
	5	246.7	2	238.2	1
	6	268.8	0	256.8	0
	7	258.2	0	259.4	0
M.	1	187.4	8	173.6	7
	2	167.8	5	133.8	8
	3	192.6	7	133.1	9
	4	168.5	8	137.9	12
	5	203.0	5	162.4	8
	6	222.4	2	224.5	2
	7	250.0	0	208.6	2
J.	1	187.0	4	184.2	9
	2	218.5	4	216.4	7
	3	208.3	3	219.9	8
	4	210.8	1	221.2	5
D.	1	244.1	2	208.5	4
	2	243.9	2	222.1	3
	3	256.7	5	220.1	4
	4	264.8	2	246.6	2
	5	292.3	0	220.4	0
	6	263.3	3	220.0	3

TABLE VII.

DISTRIBUTION OF CRITICAL PERCENTAGES.

Reactor.		*F-dfs.*	*S-dsf.*
W.	Totals	133	135
	Per cent.; σ	82; 200–320	82; 190–290
		61; 210–290	55; 200–270
M.	Totals	140	122
	Per cent.; σ	80; 120 250	86; 100–240
		51; 150–210	50; 120–170
J.	Totals	77	71
	Per cent.; σ	80; 170–260	83; 160–290
		54; 170–210	53; 160–220
D.	Totals	110	91
	Per cent.; σ	86; 200–310	94; 180–290
		54; 210–270	51; 190–220

Three reactors, W., M., and D., show a general difference between the two types of reactions; *S-dsf* giving a quicker reaction than *F-dfs*. The results of reactor J. show no material difference between the two types.

No definite deductions should be made from these results, although they open up interesting hypotheses. We hope to extend the experiments along the lines herein mapped out, and to carry out two other experiments on similar lines. The first of these will be an investigation of visual and auditory reactions with distractions, so arranged that there is no attention to either stimulus or movement until after the reaction. The results of this experiment will help to settle the questions suggested by results such as we have summarized above.

The second experiment will be on reactions to a visual stimulus whose duration (physiological and psychological) is more nearly of the same order as that of the auditory stimulus we have employed; reactions to longer auditory stimuli; and reactions to visual and auditory stimuli lasting until after the reactions are over. For these experiments a new set of apparatus is necessary. A third relevant experiment, on rhythmic reactions, is already in progress.

4. Check Experiments.

It is sometimes claimed that the Hipp chronoscope must be carefully leveled, or accuracy cannot be expected from it. We are not aware of any published experimental evidence on this point, hence we made some tests for our satisfaction. With a given adjustment of fall-hammer, current, and springs, readings were taken with the chronoscope approximately level. Then a strip of wood 1.5 cm. thick was placed under one edge of the base of the chronoscope, tipping it and readings taken in these positions. Table VIII. gives the results of this experiment.

Table VIII.

Chronoscope.	av.	m.v.
Approximately level	146.3	1.3
Left side raised	145.7	1.5
Right side raised	144.8	1.08
Front raised	146.7	1.16
Back raised	145.1	1.48

The figures given are averages of ten single tests. The experiment was repeated on another day with a different spring tension, with results of the same order. The tilting back or front is equivalent to a slight change in the tension of the springs, as may be readily understood from the construction of the chronoscope. What produced the slight shortening of the reading when the chronoscope was tilted to one side was doubtless the rubbing of the weight-cord against the side of the slot through which it runs. Tipping the chronoscope backwards or forwards did not bring the cord against the wood, on account of the direction of the slot. Side tilting of less extent does not produce any noticeable effect on the running time. It is clear that ordinary methods of leveling the chronoscope by eye are quite adequate.

To check the possible effects of variations in the intensities of the stimuli we employed, we made experiments with the visual stimulus, using three current strengths on the induction coil primary. The currents were: 3 amperes (the current used in the foregoing experiments), 1.75 amperes, and 4.5 amperes. The stronger current gave a flash distinctly brighter than that produced by the break of the normal current, while the weaker current was the lowest which would produce a dependable flash, and its flash was so pale that the reactors complained of it. Increases in current strength above 4.5 amperes produced little appreciable increase in brightness.

Experiments were made in series of ten reactions at each intensity, two series at each of the three intensities being taken in one period, in the following orders:

normal — strong — weak — normal — weak — strong
weak — normal — strong — weak — strong — normal
strong — weak — normal — strong — normal — weak

The averages for the twenty reactions of each sort of stimulus in each series are given in Table IX. The differences between reactions to the normal and to the weak intensities are considerable, but the difference between the two intensities of stimuli was large. Moreover, the reactor was conscious of the weak flash as being unsatisfactory by reason of its weakness. The differences between the reactions to normal stimuli and

those to stronger stimuli are inconsiderable. It is practically certain that no incidental variations in the normal stimuli employed in our work were of consequence.

TABLE IX.

AVERAGES BY SERIES.

Reaction.	Series.	Weak.	Normal.	Strong.
M.	1	160.7	141.1	141.1
	2	157.5	148.0	144.5
	3	149.0	150.6	153.0
J.	1	184.2	179.6	171.9
	2	158.9	139.5	137.3
	3	159.8	147.3	144.5

The influence of stimulus-intensity on reaction times needs a careful reinvestigation. The results of the experiments which have been carried on in the past convince one of very little. That differences of intensity, as such, within limits of what may be called satisfactory intensities, may cause differences of reaction time is not established. By satisfactory intensities, we mean those to which the subject reacts without noticing that they are excessively weak, excessively strong, or inadequate in some other respect. Liminal intensities, or near-liminal intensities, and excessively strong intensities doubtless are not the equivalent of moderate intensities of reaction-stimuli, even aside from their specific effects on attention. In the cases of moderate intensities contrast, novelty, specific expectations, and similar factors modifying the attention attitude are possibly the only means through which differences in intensity may produce differences in the reaction times.

THE COMIC AS ILLUSTRATING THE SUMMATION-IRRADIATION THEORY OF PLEASURE-PAIN.

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The comic and the tragic are in many respects the clearest exemplifications of the general law of emotion — the comic throwing especial light from the side of the conditions of pleasurable repose, the tragic from the side of the heightening of tone. The explosive character of these experiences, contrasted with the contemplative aspect which other forms of æsthetic enjoyment present, renders analysis comparatively easy. The culmination of the æsthetic moment is less intellectual, more sensuous, which means that it takes place in terms of grosser motor coördinations, whereas the æsthetic repose of beauty in other modes is a resolution in terms of accessory muscles, finer habits and adjustments, which do not arouse the elemental emotions or, when they do, subject them to a greater degree of control.

Up to a certain point the conditions of the comic and the tragic consciousness, as of laughter and weeping, are identical, as Darwin has sufficiently shown; but beyond that point they diverge, giving rise to distinct problems of dramatic art. It is not the purpose here to trace this divergence, but the connection is pointed out since, as will appear later, it is one of the corollaries of the present argument, that the make-believe of the tragic drama is essentially an expression of the spirit of Comedy.

I. The Summation-Irradiation Theory.

The pleasurable emotion which accompanies laughter exhibits the two fundamental phenomena of emotion as it exists everywhere: the initial summation of stimuli, followed by an irradiation or discharge which may take place either abruptly or in a more gradual way. The summation of stimuli is not pecul-

iar to pleasure, but is the condition of all emotional experience, being characteristic, as well, of pain. Thus the cumulative process in the case of sneezing or tickling readily passes from a pleasurable into a painful experience. On the other hand, the phenomena of irradiation seem to be more distinctive of pleasure, pain being due to the failure of summated stimuli to find such discharge.

Agreeable emotion is connected with such massing of stimuli as leads to a response within the normal limits of the functional capacity of the organism, while pain accompanies the piling up of stimuli and the subsequent discharge when these exceed the limits of such normal functioning. Thus moderate stimulation and exploiting of a habit are pleasurable, while any serious thwarting is painful: the habit in the latter instance may function, but this takes place under normal stress and beyond the limits of its ordinarily easy and therefore agreeable operation. Excitement and the overcoming of obstacles is pleasurable only if it results in the final triumph of a habit. Educational and other intellectual processes when kept within the confines of what is called interest are pleasurable, but carried beyond that point for the sake, it may be, of what is called mental discipline, these processes become irksome. In Mark Twain's entertaining story of the first pair, Adam and Eve in naming the animals are represented as deciding to call the toad a toad because it looked so very much like a toad. Why is it that this inane statement calls forth a smile when a scientific statement of the morphological characters of the arciferous tailless amphibian would elicit only a yawn? Because the former involves the falling back physiologically upon preëxistent habit-systems, functioning agreeably, while the latter involves their tensional reconstruction beyond the limits of such functioning.

Generalized in the more technical phraseology, the law of emotional experience has been expressed thus:[1] The conditions of pleasurable feeling are the irradiation, along lines of habitual response, of stimuli whose summation and discharge fall within the limits of the normal functioning of the organ or organs

[1] Bawden, 'The Nature of Æsthetic Emotion,' PSY. REV., Vol. XV., pp. 265–291. Also in *Principles of Pragmatism*, Chapter IV.

involved. The physiological mechanism of laughter is one of these lines of habitual response, a prominent and important one in the case of the experience of the comic. But, in addition to the cruder mechanism of cacchination, there is the less well understood but equally important system of sensorimotor connections in the cortex, with their ramifications to the finer musculatures of optical, laryngeal, and facial expression. These are of permanent importance in the case of the comic as an æsthetic appreciation, since this experience seems to attain the highest level of development under circumstances in which the cacchinatory discharge is partially or wholly inhibited.

On the physiological side our knowledge of the sensorimotor adjustments here involved is still imperfect and incomplete, although the neurologists and experimental psychologists are laying the foundations upon which an explanation will some day be built. But the analytic psychologists have carried the study of the content of the consciousness of the comic to a point which, in certain directions, enables us to make significant correlations with such physiological knowledge as we do possess. A German psychologist, Zeising, has happily epitomized the successive stages in terms which enable us to interpret this analytic content in connection with the psychophysical processes: he describes the experience of the comic as 'tension, discharge, and recovery of poise as we free ourselves.' The tension or summation is expressed by the 'expectant attention,' 'great expectations unfulfilled,' of the classic treatises. The irradiation or discharge is seen in the typically abrupt or explosive character of the comic. The recovery of poise or control is the counterpart, in the comic, of what is elsewhere known as the æsthetic repose.

II. 'Tension.'

The phenomena of summation or tension are readily recognized on the physical side in the overt reactions or incipient innervations of the motor apparatus involved, such, for example, as the convulsive paroxysms of the diaphragm and the half-born grimaces of the facial muscles. Expectancy, a prominent element in every experience of the comic, illustrates at once the 'set' of the habit-systems and the summative stimulation by

which the abrupt kaleidoscopic reorganization is to take place. The half-suppressed laughter of the titter, the giggle, and the snicker illustrate the instability of the motor mechanism. The ticklish places, as Darwin points out, are those most exposed to attack, in the sense of being the most organically vital. The musculatures clustered about such places are, accordingly, in most unstable equilibrum. The intensity of the comic experience, as we know, is dependent in part upon the state of the habit-systems immediately preceding the climax of the stimulation. This summation of stimuli is the state of expectancy. Such a state may either develop an increasingly unstable equilibrium up to the moment of discharge, as in the case of the less intellectual forms of the comic such as humor, or a distinctly antagonistic attitude may be intermittently evoked, thus enriching the cognitive content of the final discharge, as in the case of the more intellectual forms such as wit.

Expectancy is invariably utilized by a good story-teller. It matters little how the attitude is aroused. Anything will serve which will throw the listener into a state of motor instability or, what is the same thing, into a state of incipient response. Many persons secure this by themselves laughing as they recount the anecdote or tell the funny story. The contagious gestures and facial expressions of the speaker go far to put the hearer into an attitude to respond readily when the climax is reached, and all know that when such a dynamogenic attitude has once been induced, one will laugh at events and remarks which under ordinary circumstances utterly fail to evoke merriment. The reason why the ludicrous does not bear too frequent repetition and sometimes none at all, is found in this principle of expectancy.

On the mental side, the tension appears in the contrasts, contrarieties, and incongruities of the ideational content, which may take the form of practical disadaptations, intellectual contradictions, or ethical conflicts. Practical inadequacies abound in the conditions of the comic, as illustrated by the ludicrous in situation and incident and by the practical joke. The difference between this class and logical incompatibilities is simply that in the latter instance the conflict takes a less concrete and overt form.

The determination of our understanding 'to form simultaneously two contradictory statements,' to which Dumont traces the comic, is simply a psychological statement of the conflict of habit-systems. The same may be said of the theory of Sully who says that "the jest must contain something that is capable of deceiving for a moment," and of Schopenhauer for whom "the phenomenon of laughter indicates the sudden perception of an incongruity between a conceptual and a real object." The humorous character of many lapses of speech turn on such an equivocation or contradiction in meaning. The words of the preacher who in the midst of his sermon exclaimed: "Have we not all of us at times felt a half-warmed fish within us!" would not have been comic if the substitution of initial consonants had not made a certain semblance of sense. It was the arousal of this incongruous conflicting association-complex connected with 'half-warmed fish' that led to the humor of the situation when its accidental character was discovered.

The *double entendre* of the pun illustrates the rivalry of habit or apperceptive systems on a slightly higher level. The pun probably originated in a lapse. A cat chasing its tail is jumping at conclusions, to be sure, but since the fore-part of the sentence arouses one apperceptive system and the latter part such a very different one, a momentary conflict is set up which resolves itself agreeably as we at once vindicate the cat and save our logical terminology. The same general principle may be recognized as operative in the reply of David Garrick (who was small of stature) to a woman who had expressed the wish that the great actor were taller, that he might appear to better advantage on the stage: "Truly, madam," he said, "I am sorry that I cannot stand higher in your estimation."

Most theories of the ludicrous have dwelt on the factor of incongruity. And this is doubtless indispensable in order to bring about the tension whose sudden resolution results in the irradiation prerequisite to the pleasurable emotion. But equally important and even more fundamental is the factor of congruity. Mere surprise, abrupt transition or sudden movements will make the child laugh, but such cacchination is scarcely to be regarded as expressing an appreciation of the comic, being probably a

mere reflex. It is essential to the comic as an æsthetic experience that there shall be a more or less elaborate background of meanings the disturbance of which is the condition of the incongruity. The situation must first mean something before the irruption of a new meaning can create a conflict of meanings. Sully quotes Rolfe as saying that "he who cannot enjoy nonsense must be lacking in sense." Nonsense is not no-sense but a category of sense. This raises a question the satisfactory answer to which would involve a nice piece of discriminative introspection and analysis: How irrelevant may the details of a situation be and yet be ridiculous, or, in other words, what are the limits within which congruity and incongruity are comic?

It is evident that the disadaptation or incongruity must not be too great nor involve serious practical or ethical consequences, and, on the other hand, the unexpected congruity must not be too relevant or morally significant. When, with Lord Raleigh, we call the negro 'God's image carved in ebony,' the felicitous expression, for many persons with vivid memories of the issues of a bloody war, is too significant to be comic. So with Thomas More's remark to the headsman, that although he required assistance in mounting the scaffold, he would shift for himself in coming down. One may smile only when he is able to abstract from the actualities of the situation.

Discrepancies on the moral side are less easily interpreted. The fact of inconsistency with some ethical standard may have something to do with the tensional phase, and possibly the consciousness of superiority in the subject may explain the pleasure gotten from contemplating moral delinquency on somewhat the same principle that the savage and the child laugh at physical deformities and the uncultivated laugh at a stupid remark. But probably the comic element in the immoral lies in the momentary relapse of the conventional mind to some more primitive type of reaction. This is certainly borne out by the jokes on sacred subjects, the coarse jokes of the 'virile' man in uncovering sexual matters, etc. Many writers have hinted that there is something essentially immoral in the comic. Charles Lamb suggests that a leading element in the enjoyment of certain forms of comedy consists in the fact that they free us

from the burden of our habitual moral consciousness. Aristotle says that Comedy is "an imitation of characters of a lower type, and that the ludicrous is a subdivision of the Ugly, consisting in some defect or ugliness which is not painful or destructive." The Fuegians, says Sully, laughed uproariously at a white man's washing his face, and adds that the comic involves the "presentation of something in the nature of a defect, a failure to satisfy some standard requirement, as that of law or custom, provided that it is small enough to be viewed as a harmless plaything," such, for example, as failure to comply with a social convention, yet "so trifling that we do not feel called upon to judge the short-coming severely." This theory of degradation or principle of lowered dignity is often called the moral theory of the comic, since it holds that there is something unworthy or mean and contemptible in the ludicrous object.

III. 'Discharge.'

The irradiation or discharge and subsequent recovery of poise as we free ourselves is due to the relatively abrupt coalescence and reinforcement of habit systems. The relative unexpectedness, abruptness, suddenness, surprise of the final resolution of tension has been dwelt upon in all attempts to analyze the comic situation. The ludicrous, as one writer has phrased it, is "an approximately instantaneous revelation of an incongruous congruity." Laughter, says Kant, "is an affection arising from the sudden transformation of a strained expectation into nothing."

In the more elementary forms of the comic the irradiation or discharge is of an abrupt and even explosive character. As has been said, mere abruptness of transition in itself, such as a sudden or jerky movement, is sufficient to make a young child laugh, and this is part of the stock-in-trade of the professional clown. It is true also that "brevity is the soul of wit." "When we hold our breath in expectation, and then undergo a violent change of tension through the expectation coming to nothing," says Bosanquet, "we certainly go through a process like that which Kant describes" in his famous definition of laughter.

Abruptness in the cruder sense is not however indispensable,

as is evident from those types of the comic in which one feels suffused with the humor of a situation or quietly wrapped in the pleasurable moment rather than swept away or convulsed by it. Thus the story is told of a lad who was kept after school and punished by being required to write an essay of one hundred words. He wrote the following composition: "Jack went to the door and called 'Kitty, kitty, kitty, kitty' . . . (ninety-three times)." All that seems necessary in many instances is the establishment of a connection, involving not too many transitions, with some apperceptive system which has pleasant associations, as, for example, when the patriotic geographer said that America was bounded on the North by the Aurora borealis, on the South by the torrid zone, on the East by the history of the past, and on the West by the Day of Judgment.

The factor of surprise in the emotion of the ludicrous is the emotional counterpart of the fact of irradiation. The relief of the laugh and the repose of the smile illustrate the effects of the pleasurable diffusion of accumulated energies. In ordinary cases of the comic, as Sully says, "the disagreeable feeling of disturbance begins at once to give way to a pleasurable form of consciousness," the whole experience being best described as a "transition (or rapid series of transitions) from a feeling of confinement or contraction to one of liberation or expansion."

IV. 'Recovery of Poise.'

The prerequisite of the comic is that we shall be left in control of the situation; as Miss Puffer says, there 'must be a way out.' In accordance with the theory of emotion which has been set forth, the comic is connected with the fact of relatively abrupt relief from the tension which accompanies the vigorous exploiting of habit-systems. The smile, Sully remarks, is the position of the features when food is presented, the laugh being merely the smile combined with the *ch* sound which expresses relief from tension. The sense of relief comes from the fact that the apparent break or disadaptation suddenly turns out to be really an adaptation. Its pleasurable character is due to the fact that the summated energies of the organism are thereby enabled to irradiate along familiar lines before the inhibition

has been carried to the point of pain. The comic thus describes the same situation that, beyond a certain point, would be called tragic. As Horace Walpole put it, life is a comedy to him who thinks, but a tragedy to him who feels.

The consciousness of superiority or sudden glory in the subject, of which Hobbes speaks, 'taking somebody down,' or, what is the counterpart of this, the sense of inferiority or degradation in the object, would seem to be but clumsy ways of expressing this fact of control. Bain follows him in defining the occasion of the ludicrous as "the degradation of some person or interest possessing dignity in circumstances that excite no other strong emotion." Lipps says that in the incongruity there must be a belittling presentation. Carlyle in milder terms speaks of a sense of the ridiculous as a brotherly sympathy with the downward side. "Twenty-seven millions, mostly fools. Well, better fools than knaves."

The savage laughs at the sight of a man chastising his wife. We laugh at the little mischance of capsized pompousness, at inflated pride followed by a fall. We smile at the embarrassed youth, the bashful maiden, the naïveté of the child. We laugh at the German, mentioned by Sully, who when asked how his wife was, said: "She is generally lying, and when she is not lying she is swindling," meaning to say 'lying down' and 'feeling giddy' (hat Schwindel),— and at the child who when asked, "Isn't Grandpa very kind to play with you, Dear?" replied: "I'm playing with *him*," — and at the old lady who said she could grasp the fact of the astronomers' finding new stars with their improved telescopes, but what she could not understand was how they discovered their names.

The ludicrous character of the grotesque, burlesque, satire, ridicule, the lampoon, and the practical joke all lend themselves to this interpretation. Humor and wit are less easily explained. And, yet, it is believed that a careful analysis will show that the principle holds here as well, as disclosed by the social value of a sense of humor. Laughter because of its contagiousness and its effect in cementing social distinctions is one of the most powerful factors in developing a sense of social solidarity in the individual. Ridicule is one of the instruments evolved by the

group for the socializing of its recalcitrant members: it rounds up the mavericks of the human herd — the prigs and pedants, cranks and dreamers, the absent-minded man, the man-of-one-idea, and the man-behind-the-times.

"Anything in the shape of a feeling of inferiority to, or even of respect for, the laughable person inhibits the laughter of the contemplator," says Sully, or "if a person finds himself distinctly involved in a disgrace, the absurd situation, or whatever else provokes laughter, he no longer laughs, or laughs in another key. I see my estimable fellow-pedestrian lose his hat at a street corner where the wind lies in ambush: my soul expands exultingly. The moment after, I, too, may fall a victim to the ambuscade, in which case I probably stop laughing and become the subject of a different emotion." And another fact is still more decisive. "If no superiority is implied in our common laughter at others, how does it come about that we all have so very obstinate a dislike to being made its object?"

V. The Comic and the Tragic.

This suggests, in conclusion, that laughter is the most primitive æsthetic experience. To weep, it might be said, is equally elemental, but, save in Tragedy, it is not æsthetic, whereas the roots of the comic reach far back of the origins of Comedy. The essence of the æsthetic experience is a stimulating repose, just what we find, for the first time clearly, in primitive laughter — a rudiment upon which Tragedy is grafted at a comparatively late date by a curious process of inversion.

The primitive hunt dance, an extemporaneous celebration, perhaps, of some recent triumph, is only an elaboration of the sigh of relief and the consciousness of success which follow upon any strenuous activity. The more or less detail of stimulating ideational content which accompanies this emotional overflow is naturally derived from the serious occupation which has been thus brought to a satisfactory culmination. This content, if it serves to sustain and control such an emotional outburst, is in a fair way to become æsthetic, inevitably first taking the form of Comedy, since it is a universal law of emotion to expand pleasurable and restrict painful fields of consciousness. That

this would be so is borne out by the fact that in early pantomime the portrayal of tragic situations often passes insensibly into real tragedy, a mock war dance, for example, ending in a bloody conflict.

The tragic, while doubtless present to the fullest extent as a part of the material represented in such a dance, is there however not to excite a vicarious pity and fear, in the sense which Aristotle attached to these words, but simply as a feature of the revived content thrown into the central glow of the dramatic representation in so far as it contributes to the enhancement of the total pleasurable recall. It would seem to require a considerable advance in sophistication and self-analysis before the tragic emotions might be held in suspense on the attenuated thread of conscious self-illusion, and the development of a high level of inhibition and self-control before a vicarious might supplant the immediate response to so strong a stimulus. The comic, therefore, as a form of art, would appear to antedate the tragic, however intimately they may be originally associated in the direct experience.